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ABSTRACT

To establish normative standards against which to contrast the speaking performance of aphasia patients, a sample of 54 adults representing a broad range of age and education were administered the picture cards of the Thematic Apperception Test to stimulate speech. The stories thus elicited were tape recorded. Each word spoken was grammatically classified. The data demonstrated the existence of highly consistent individual differences among normal speakers in the relative frequency with which they used various grammatical classes. By factor analysis six dimensions of individual difference were defined. A group of 24 aphasia patients also responded to the pictures. Analysis of their speech suggested that grammatical class usage and the dimensions represented by the factors "descriptive specificity" and "richness of vocabulary" were appropriate measures for differentiating speech of aphasia patients, as well as normals, and for characterizing change over time in recovering aphasia patients. (KB)

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GRAMMATICAL INDICANTS OF SPEAKING STYLE IN NORMAL AND APHASIC SPEAKERS

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GRAMMATICAL INDICANTS OF SPEAKING STYLE IN NORMAL AND APHASIC SPEAKERS*

Linguistic theorists, stimulated largely by Chomsky, Halle, and their colleagues, have shown increasing concern with establishing a minimal set of mental processes deemed necessary to the competent user of a natural language. These efforts may be viewed as directing attention to the equipment of an "idealized" speaker (and listener), one who enjoys complete proficiency in the language. It is then assumed that all users of the language are equipped with the same processing capability as is the idealized user, albeit with varying degrees of efficiency.

This interest in the development of rule systems which are considered common to a community of language users promises to yield an important theory of the language user--important both in Linguistics and in Psychology. Yet the existence of this theoretical program in linguistics need not preclude other

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approaches to the study of language use. One such approach, with both practical and theoretical implications, aims at specifying useful dimensions of individual differences among speakers of a language. Features of speech which characterize the utterances of a particular speaker we will refer to as his "speaking style". One set of speech characteristics related to speaking style are temporal features, about which other conference participants have spoken. We will be concerned less with hesitation phenomena and more with differences among speakers in terms of their characteristic use of words from differing grammatical classes.

That individual speakers can be distinguished reliably from their use of grammatical classes of words has been repeatedly reported in the journal literature (Balken and Masserman, 1940; Sanford, 1941, 1942a, 1942b; Fairbanks, 1944; Lorenz and Cobb, 1952, 1953, 1954; Gottschalk, Gleser, and Gove, 1957; Fein and Allen, 1958). The studies reported in the present paper are in the tradition of this past work, but involve a systematic effort first to determine prominent dimensions of speaking style for normal adult English-language speech, then to assess the speech of brain-damaged aphasia patients with reference to those stylistic dimensions.

A study of normal speakers

In any investigation of individual differences, including individual differences in speaking style, it is essential to establish normative standards against which to contrast performance of any individual or subgroup of individuals. We have chosen a normative sample of 54 speakers ranging in age from 18 to 80,

in education from second grade to completion of the Ph. D., representing both sexes and a wide range of socioeconomic conditions. As a means for stimulating speech we administered to each subject the 20 cards of the Thematic Apperception Test. The stories produced were tape recorded, carefully transcribed and edited. The mean number of words produced by our speakers was slightly greater than 2500.

Each word spoken by any speaker was grammatically classified, using the system proposed by Jones, Goodman, and Wepman (1963). The grammatical classes are listed as "variables" in Table 1, along with the mean proportion of use of each.

Variables 1-4 are comprised of pronouns, separated a priori into four classes, Personal Subject Pronouns (I, he, she, we, they), Personal Possessive Pronouns (my, his, our, their, your), Personal Object Pronouns (me, him, us, them), and Indefinite Pronouns (it, this, and that when used pronominally rather than as a Relative). The separation of pronouns into distinct subclasses is justified empirically by the low intercorrelations between the subclasses, range from -.31 between 1 and 2 to .45 between 1 and 4, and also by the differing correlations between these subclasses and other selected variables, some of which are displayed to the right in Table 1. (All correlations reported were obtained over speakers, after having transformed proportions of use of each grammatical class by an arcsine transformation.) Several pronouns were excluded from the analysis, the words "you" and "her" because of ambiguity of subclassification, reflexive pronouns because of their infrequent occurrence.

Table 1. Data From TAT Responses of 54 Normal Adults

	Variable	Mean	Selected correlations			
			Uncom. noun	Common noun	Uncom. verb	Common verb
1	Personal subj. pronoun	.070	-.76	-.71	-.24	.71
2	Personal posses. pronoun	.009	.43	.14	.38	-.24
3	Personal obj. pronoun	.010	-.12	-.30	.19	.25
4	Indefinite pronoun	.049	-.60	-.47	-.46	.50
5	Common noun	.068	.42	--	.03	-.52
6	Uncom. noun	.064	--	.42	.50	-.81
7	Common verb	.086	-.81	-.52	-.55	--
8	Uncom. verb	.033	.50	.03	--	-.55
9	Common adj.	.019	.01	.14	.14	-.17
10	Uncom. adj.	.029	.64	.39	.46	-.70
11	Education		.65	.35	.31	-.47
12	Adverb	.075	-.60	-.27	-.31	.43
13	Article	.075	.79	.75	.18	-.74
14	Indefinite	.010	-.55	-.20	-.43	.54
15	Auxiliary	.128	-.61	-.34	-.48	.44
16	Preposition	.121	.39	.42	.18	-.24
17	Interjection	.012	-.36	-.54	-.43	.38
18	Repeated words	.009				
19	Hesitation sounds	.035				
20	No. of words	2527				
21	Relatives	.024				
22	Quantifiers	.029				
23	Conjunctions	.068				

Nouns, verbs, and adjectives each were divided into "common" and "uncommon" subclasses, depending upon whether a particular word occurred at an average rate greater or less than 1 per 5000 running words. Again, the different correlations, particularly for Common vs. Uncommon Verbs, supplies empirical justification for the distinction.

Variable 11, Education, is coded as a three-valued variate depending upon whether a subject had failed to complete high school, had graduated from high school, or had been enrolled in college. Equal numbers of subjects represent each of these three educational levels. Variables 12 to 17 are largely self-explanatory, with the exception of the "Indefinite" class--words such as "something", "somebody", "someone", "anything", "nothing", "everything", and "someplace".

Variables 18 and 19, while not grammatical classes, are included for their special interest in assessing speech of brain-damaged aphasia patients. The first immediate repetition of a word just uttered is classed as a "Repeated Word"; "Hesitation Sounds" are the "uh's", "ah's" and "um's" of the hesitant speaker. "Number of Words" is the total number of words uttered by a speaker, excluding repeated words and hesitation sounds.

"Relatives" are words such as "what", "who", "when", "where", and "which". "Quantifiers" are quantitative modifiers such as "all", "some", "much", "more", and all ordinal and cardinal numerals. The "Conjunction" class is self-explanatory.

Incidental to the study of speaking style, we have some results pertinent to the relative frequencies of individual words spoken to TAT pictures. The most popular six words: is, the, and, a, to, and I, account for more than one-fifth of all words uttered. Half of all utterances are accounted for by 33 distinct words. (In the Thorndike-Lorge written word count, 88 words are required to account for half of all occurrences.)

Among the most common 50 words appears only one noun, MAN, 46th in rank, but six verbs, LOOK, THINK, KNOW, GO, SEEM and SEE. Among words classed as auxiliaries are IS, BE, DO, HAS, HAVE, WOULD, ARE, WILL and CAN. Pronouns among the first 50 words are I, IT, HE, SHE, THIS, THAT, HER, HIS, THEY, YOU and HIM. Remaining words include 9 prepositions, 4 adverbs, 3 conjunctions, 2 quantifiers, 2 articles, a relative, an indefinite (SOMETHING), and the interjection WELL. The most frequently appearing adjective is "YOUNG", which ranks 70th among all words in mean frequency of occurrence.

Evidence for remarkably stable individual differences in usage of different grammatical classes is seen from scanning intercorrelations, over subjects, between relative frequencies of use of the classes, some of which appear in Table 1. Startling is the unexpected magnitude of some of these correlations. Not anticipated is the sharply different behavior of common and uncommon noun vs. common and uncommon verbs. The user of uncommon nouns tends also to use common nouns, articles, possessive pronouns,

uncommon verbs and adjectives, and prepositions, underusing personal subject and indefinite pronouns, common verbs, adverbs, indefinites and auxiliaries. An inverse pattern is observed for the common verb user, who also tends to underuse uncommon verbs. It is clear that common verbs may readily substitute for uncommon verbs, while common and uncommon nouns more often complement one another in speech from a given speaker.

The sizable intercorrelations among part-of-speech classes suggested that a factor analysis might be productive for defining "dimensions" of individual difference among normal speakers. Correlations were analyzed to yield a principal axes factor solution, which was followed by varimax rotation. Several criteria agreed in specifying six common factors, which are described by the columns of Table 2. Interpretation of the factors is accomplished (1) by assessing the projections of variables on each factor, attending particularly to variables which display markedly nonzero projections, and (2) by contrasting speech of speakers who display high and low scores on each factor.

To illustrate these procedures, consider the definition of Factor A, a prominent dimension of style, which accounts for 21 percent of the total individual difference variance. Factor A displays large positive projections for Articles, Uncommon and Common Nouns, Educational level, Uncommon Adjectives, and Prepositions. In contrast, large negative projections appear for Personal Subject Pronouns, Common Verbs, Adverbs, and Indefinite Pronouns.

Table 2. Varimax Factor Structure

	Variable	Factor A	B	C	D	E	F
1	Personal subj. pronoun	-.88	-.06	-.18	.15	.11	-.04
2	Personal posses. pronoun	.15	.16	.80	-.09	-.06	.00
3	Personal obj. pronoun	-.34	.05	.53	-.01	.09	.24
4	Indefinite pronoun	-.42	-.36	-.08	.60	-.12	-.10
5	Common noun	.71	-.02	-.08	-.31	-.26	-.11
6	Uncom. noun	.74	.48	.30	-.11	.03	-.01
7	Common verb	-.70	-.60	-.03	.07	.10	-.08
8	Uncom. verb	.06	.66	.30	-.31	.01	.00
9	Common adj.	-.09	.27	-.12	-.14	-.59	.02
10	Uncom. adj.	.50	.63	-.13	-.13	-.12	-.04
11	Education	.51	.29	.10	-.31	.25	-.01
12	Adverb	-.45	-.15	-.54	.15	-.04	.23
13	Article	.92	.12	.06	-.23	.02	.01
14	Indefinite	-.25	-.59	-.35	-.04	-.04	-.11
15	Auxiliary	-.38	-.23	-.42	.53	.07	-.22
16	Preposition	.43	-.26	.49	-.54	-.12	.02
17	Interjection	-.31	-.17	-.06	.71	-.01	.24
18	Repeated words	-.27	.02	-.04	.14	-.13	.48
19	Hesitation sounds	.10	.06	.06	-.10	.23	.77
20	No. of words	-.10	.36	-.16	-.13	.37	.16
21	Relatives	-.06	.22	.13	.12	.45	.00
22	Quantifiers	.20	.06	.08	.06	-.31	.36
23	Conjunctions	-.07	-.01	-.20	-.26	.59	.00
	$\Sigma a^2/23$	.210	.107	.092	.088	.062	.054

As a common reference, we shall cite several examples of speech in response to Card 11 of the TAT. This card depicts a rather ill-defined scene, reproduced as Fig. 1. Here is the story recounted by one subject who displays a factor score of -2.11 in standard-score form:

"This must be somewhere in the woods. I think so because I can see trees and, is someone camping there? No doubt, I think so. Although I don't see any people. What is that? I don't know. I don't even see people there but it's, are those animals?"

A speaker with a standard score of 2.00 on Factor A spoke as follows in response to Card 11:

". . . Well I can't tell for sure just what this indicates. It's, eh, it looks like a r-rural, scene. . . Some natural structure ehm . . . of stone. . . with some rocks to the side. . . Looks like a eh, a building. . . at the right hand side constructed of eh, stone. . . And in the immediate foreground, seems to be eh. . . some trees. . . and eh, in the upper left part. . . seems to be some kind of a, animal that I eh, just couldn't identify. . . . Although it has a eh, . . . long neck. . . with a . . . . a bill and also a foot extending out. . . webbed like, somewhat like a duck's, like a duck's foot. . . . It looks as if there might be some life there on the eh. . . on some structural, structure that seems to. . .

seems to have an arch. . . . But I can't make out from the eh picture. . . whether those are actually some kind of a , birds. . . at the front it does actually look like a, a bird."

It is tenable to consider an interpretation of Factor A in terms of the "descriptive specificity" of a speaker's response. Detailed descriptions of the picture tend to require use of articles, nouns, adjectives, and perhaps prepositions. More general, nondescriptive statements are characterized by high frequencies of personal and indefinite subject pronouns, common verbs, and adverbs. Descriptive specificity is more likely to characterize speech from subjects of high educational level, and it is seen that education does display a positive projection on Factor A.

Turning to Factor B, it is seen to be defined by Uncommon Verbs, Adjectives and Nouns, in contrast to Common Verbs and Indefinites.

The following response to Card 11 was made by a speaker low on Factor B (with a score of -1.34):

"Looks like a cliff. . . There's some kind of rock formations. . . and there it looks like there's something on the cliff, and I can't make out what it is. . . . And there's one formation that has the face like the crocodile. . . and whatever is on the cliff is, has a, is like, he has a light shining around it. . . .

Probably it looks like, it's probably from the sun.

The sun is probably right behind it."

Another speaker, with a Factor B score of 2.32, responded to the same picture as follows:

"This is apparently a scene in Califor[illegible], in the early days when John Muir, and those who, like him, sought the pleasures of the illimitable spaces of the far West, were enjoying life on the slopes of the Rocky Mountains. The year is approximately 1850, the year before the, ah, Valley of the Yosemite was discovered by a military party, pursuing some Indians that had committed some depredations on the miners, and ranchers, and ah farmers in that particular area."

Factor B appropriately might be called "richness of vocabulary". Speakers high on this factor uniformly use more uncommon nouns, verbs, and adjectives, use fewer common verbs and indefinites, and tend to have a higher educational background.

In like manner, interpretations have been developed for the remaining, smaller, factors. Factor C, defined by prepositions and predicate pronouns, appears to reflect a tendency towards use of pronominal prepositional phrases. Factor D, defined by interjections, indefinite pronouns and auxiliaries, indicates the frequent use of a phrase such as "Well, it is. . ." in describing the pictorial stimuli. Factor E probably represents a tendency toward use of a conjunctive form, related also to a high frequency

of Relatives, and, to a tendency towards verbosity. The appearance of "Number of Words" on this factor suggests the hypothesis that conjunctions may be "overused" by some speakers as an effort to maintain conversation in the face of attempted interruptions. Finally, Factor F represents hesitancy in speech, reflected by frequent hesitation sounds and immediate word repetitions.

In considering these factors as dimensions of speaking style, we must stress the reservation that that they are derived solely from stories told to TAT pictures. No evidence has been presented to show that the dimensions are appropriate for describing individual speech differences in other conversational situations. However, from some completed analyses of speech produced in other circumstances, it would appear that at least Factors B, C, E, and F do have the status of generally useful stylistic dimensions. Factor A, in particular, perhaps is more specific to a storytelling mode of oral response.

Application to aphasia

Aphasia is a disorder, resulting from organic impairment of the central nervous system, of the abilities necessary to formulate or comprehend verbal symbols (Wepman and Jones, 1961, p. 74).

We recognize that among aphasia patients there may be a wide range of language performance. By their performance, two prominent subgroups of patients may be identified. For one group, there is marked difficulty in remembering and using substantive words except, possibly, for the most frequent and general. This disorder has been called anomia, although we prefer the term

"semantic aphasia", recognizing that the problem is not restricted to nouns or names, but occurs with most words of relatively low frequency and high informational value. A second group of aphasic speakers exhibits little difficulty in recalling and using substantive words, but is unable to embed these words in a grammatical structure. With the exception of occasional short and popular phrases, these patients misuse or altogether omit most of the function words of the language, often resorting to a telegraphic style of speech. The disorder has been called agrammatism; we refer to it as "syntactic aphasia".

In a group of 24 aphasia patients, we have analyzed the speech produced to the 20 TAT pictures by the same methods used for the normal speakers. In addition, for each patient, we determined the proportion of all words uttered which appear on a list of 402 words that for normal speakers, are unambiguous in grammatical class and occur at a rate of at least 1 per 5000. For the sample of 54 normal speakers, the mean proportion of word occurrences which appear on this list is .83.

Based upon the proportion of usage of frequent words, aphasia patients were separated into three groups of eight patients each. For the top third of the patients, between 86 and 88 percent of words uttered were comprised of these frequent words. We consider these eight patients to suffer from a semantic disorder; a very high proportion of their utterances consist of words expected with high frequency in normal speakers. For the bottom third of patients, between 66 and 79 percent of words uttered appeared on the list of

frequent words. These patients used common words even less frequently than normal speakers. We consider this third of patients to include those with syntactic disorders.

For all of these patients, factor scores were determined on Factor A. Remarkably, for the upper and lower thirds of patients--the asemantic and asyntactic subgroups--there is no overlap in distribution of scores on Factor A. The semantic group display a range of Factor A scores from -2.56 to -.29, with a mean of -1.31. For the syntactic group the range is -.12 to 3.97 with a mean of 1.35. (The range for the middle third of patients is -1.68 to 1.38, with a mean of -.27.) This result lends support to the interpretation of Factor A as representing descriptive specificity, for semantic patierts who use common low-informational words score low on the factor, while syntactic patients who use more uncommon words, presumably appropriate to a particular communicative goal, score high on the factor. Further, to the extent that the factor interpretation is valid, this result helps explicate the nature of differences among these two classes of aphasia patients.

There is perhaps a third aphasia problem, less frequently observed than semantic or syntactic aphasia, which we refer to as a pragmatic disorder. Here the patient seems unable to associate incoming signals with appropriate concepts, and his speech conveys little meaning to a listener. The difficulty has been described by Luria as "a breakdown in the regulatory function of speech connections" (Luria, 1961). In response to Card 2 of the TAT, one

such patient responded as follows:

> "Well, all I know is, is somebody is clipping the krepples, and some why, someone here on the kureping arm, why I don't know. I don't know. I can't. I can't so that I can't understand that. . . .Go, here is this. . . . And then you got this blot, to tell them right see. Now this here, I'm, I'm confoy here because they have explained what. I don't know. I don't know."

Two months later, this patient has shown considerable recovery. His speech yields evidence of semantic difficulties, but the relation to the stimulus pictures is much more nearly normal. His response now to Card 2 is:

> "Well, this is a woman. . . young girl, and she has got two and. . . ah, watching a, a man and what looks to be a, somebody older, watching. They make a young doing of frat, trying to one on the tork. . . Geez, that darn word. On the young tork. I can say it but I can't say it. That these young people used in the . . ."

A year later, his speech was nearly normal, but with occasional syntactic errors. His story to Card 2 at this time was:

> "There is a, a man plowing a field. . . and on one side of the, ah, field is his, ah, apparently his wife, leaning up against a tree. And there is a very attractive girl, I would assume they are his,

ah, daughter, with two books in her hand and she is going to school. I would assume that the, ah, parents aren't, ah, well, ah, read, and therefore, ah, maybe the mother is pretty angry that the daughter is going away to school, while she is, ah, working in the field with her husband, ah. He is not exactly a very fine looking house, and I would say that they're from a, ah, poor people in this neighborhood, ah. There is no other evidence to use, a story at, at this moment about this pike, ah, picture."

Figure 2 displays proportions of use of common verbs, personal subject pronouns, and nouns for this patient on each of eight successive story-stelling samples collected over a period about 18 months. Notable is the rather consistent shift of usage from the pragmatic-speech stage of samples 1 and 2, through the semantic stages of samples 3-5, to the syntactic or near-normal speech of later samples. It may be of interest that adverbs and auxiliaries also display changes much like those of common verbs and pronouns, while prepositions systematically increase in the same manner as nouns.

Figure 3 shows scores on Factors A and B for these same eight samples of speech for this patient. It is seen that both Factor A, representing descriptive specificity, and Factor B, representing richness of vocabulary, rather systematically increase over the

Fig. 2. Proportions Of Selected Grammatical Classes For Eight Successive Speech Samples From A Recovering Aphasic Patient

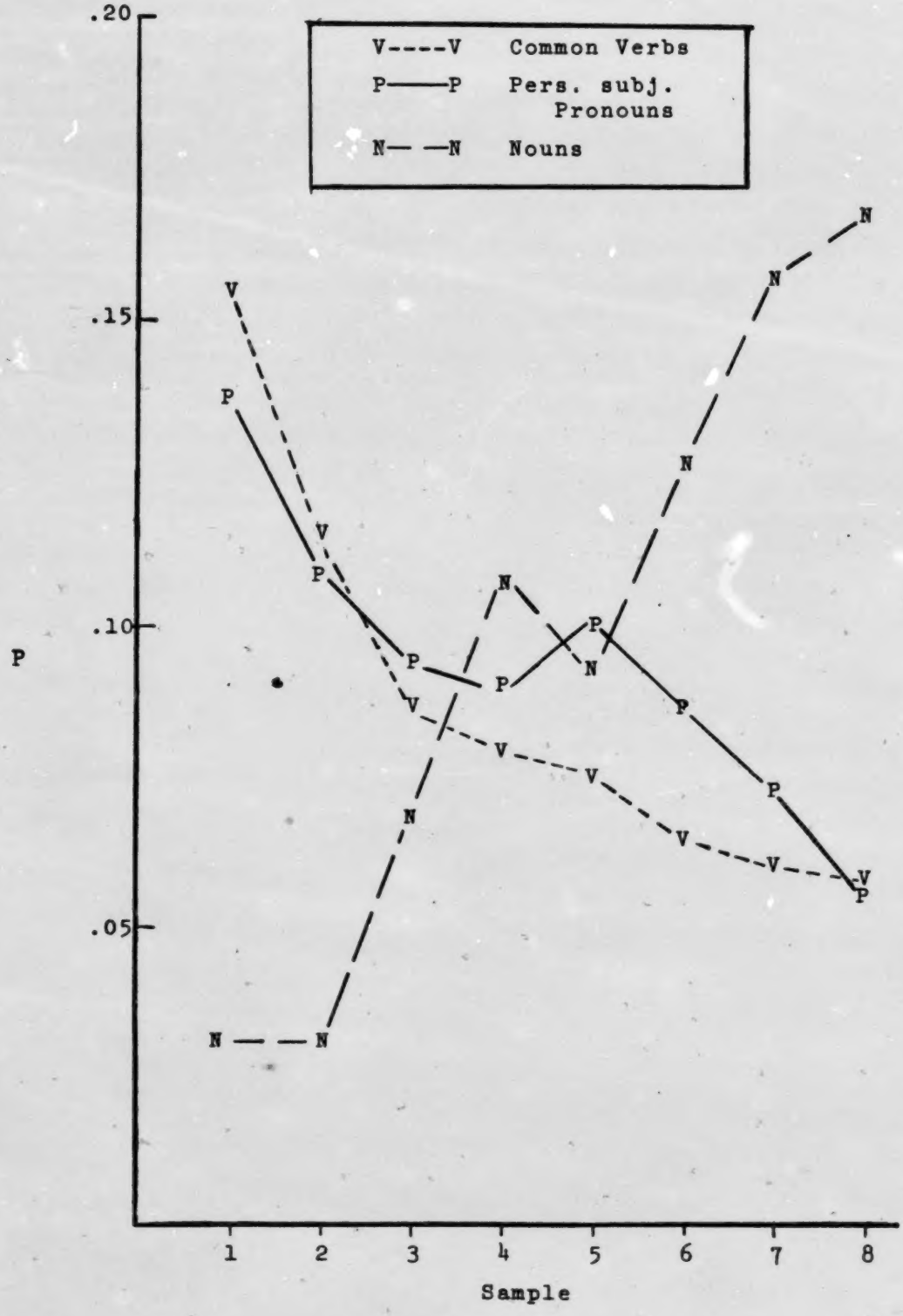
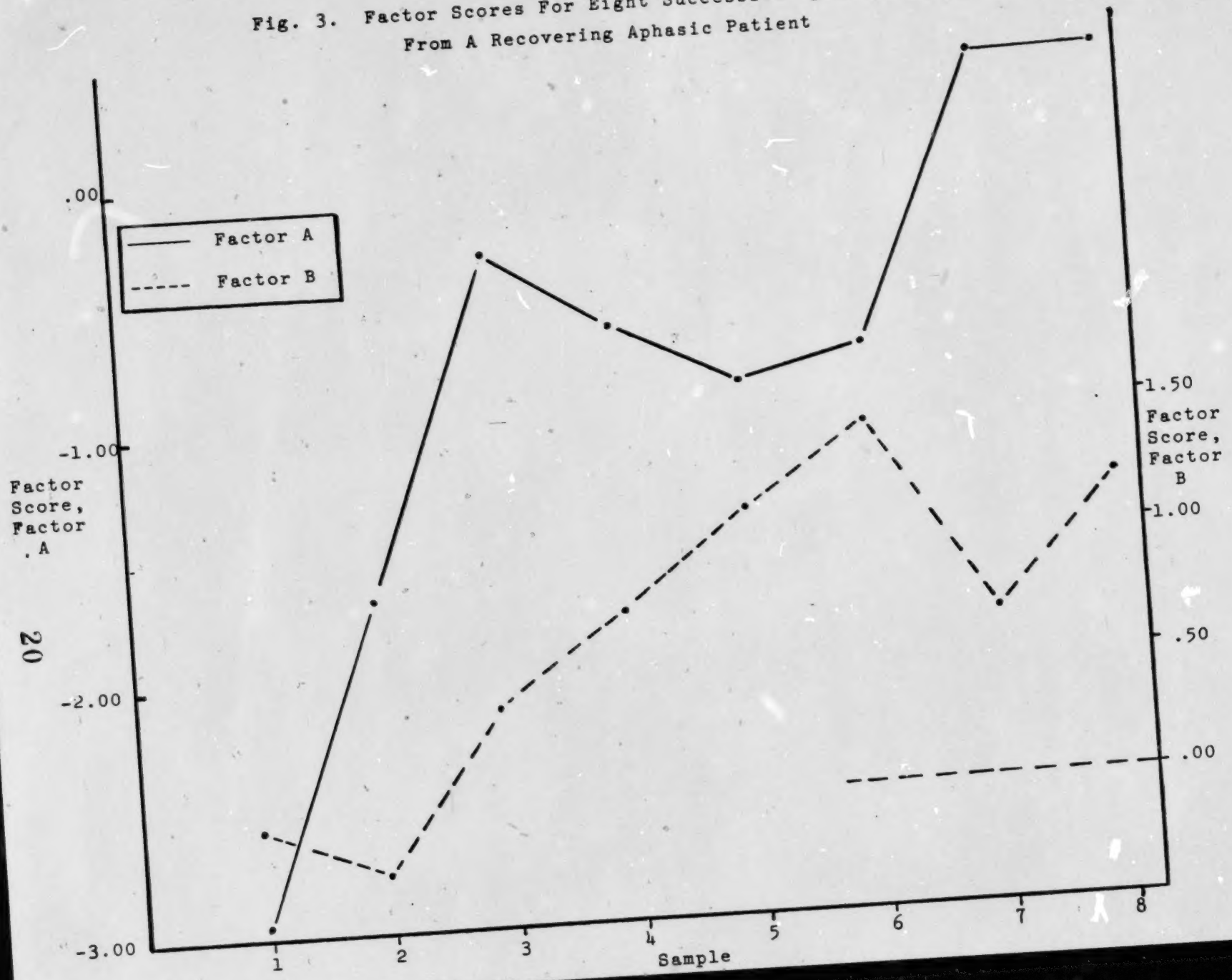


Fig. 3. Factor Scores For Eight Successive Speech Samples From A Recovering Aphasic Patient



period of recovery.

These results are of interest for at least two reasons. First, they suggest that grammatical class usage and the dimensions represented by Factors A and B are appropriate measures for quantitative assessment of the speech of an aphasia patient. Certainly the goal of achieving such measurement is important, since quantitative characterization of speech performance is a requisite for research aimed at relating speech behavior to neurological deficit or to therapeutic agents. Also, these results suggest the possibility that patients may not be subject to classification into stable subgroups such as semantic, syntactic, or pragmatic aphasia, but rather a single patient may display symptoms of each class at differing stages of language recovery.

Discussion

Our investigation has demonstrated that there are highly consistent individual differences among normal speakers in the relative frequency with which they use various grammatical classes. By factor analysis, several dimensions were discovered, some of which were found useful for differentiating speech of aphasia patients as well as normals, and for characterizing change over time in a recovering aphasia patient.

Results suggest that the analysis of grammatical-class frequencies is a promising approach to a number of problems concerning individual differences in speaking style. It would be of interest to study the development of speech in childhood in terms of gram-

matical class usage and the dimensions discovered here. (Preliminary evidence suggests that pre-school ages may be of greatest interest; by age 7, the language usage of children, in terms of our measures, seems to fall within the range observed for normal adult speakers.) It would also be valuable to study conversational situations other than story-telling, to better ascertain the generality of the present results. Also of interest would be attempts to utilize units of speech of greater linguistic interest than the individual word for distinguishing style of speech. Frequency of various inflectional forms or relative frequency of various types of phrases come to mind as possible candidates.

For the study of aphasic speech, the present methods of analysis may provide a means to characterize premorbid speaking style of speakers, relating that to the pattern of speech following cortical insult. While posing some difficulty in sampling design, such a longitudinal study, beginning with likely candidates for cerebro-vascular accident, would seem feasible. Finally, to the degree that aphasia patients differ with respect to speaking style as measured by these procedures, there is a challenge to relate these specifiable behavioral differences to the form of neurological damage.

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